



Department of Energy
Washington, DC 20585

MAR 16 2004

Mr. Karim Amrane
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Dear Mr. Amrane:

I am writing in response to your November 4, 2003, letter which was in response to our letter of July 25, 2003, and a follow up to the October 1, 2003, meeting regarding Single Packaged Vertical Units (SPVUs).

In our July 25th letter, we stated our belief that Addendum d to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2001 (Addendum d), as originally presented, was intended to establish single packaged vertical air conditioners (SPVACs) and single packaged vertical heat pumps (SPVHPs) as new categories of heating, ventilating and air-conditioning equipment and to establish test procedures and standards for these products, but that it did not accomplish what was intended. We also stated that the Department could not adopt Addendum d's standards and test procedures as Federal requirements, for the following reasons. First, under its literal terms, the Addendum appears to prescribe requirements for few if any products covered by the Energy Policy and Conservation Act (EPCA). Second, to the extent Addendum d prescribed standards and test procedures for SPVUs that are covered by EPCA, it did so in a way that was unclear and not in accord with the statutory scheme because it disregarded EPCA's definitions and classifications for air-conditioning products. And third, for some categories of products, the Addendum appears to contain standards that are lower than the minimum efficiency levels currently required under EPCA. Finally, we indicated that, if these defects in Addendum d were corrected, the Department would evaluate the minimum efficiency levels set for SPVUs to determine whether to adopt these levels or pursue higher levels, and would also evaluate the test procedure adopted by ASHRAE for SPVU products to determine if it met EPCA requirements.

The Department may not adopt changes in an industry test procedure prescribed by ASHRAE Standard 90.1-2001 (Standard 90.1) if the amended industry test procedure would not meet certain test procedure requirements established under EPCA. The Department is also prohibited from prescribing any amended standard that increases the maximum allowable energy use, or decreases the minimum required energy efficiency, of a covered product.

As to the first of the issues identified in our July 25th letter, EPCA mandates that DOE evaluate amendments to Standard 90.1, for adoption as Federal standards and test procedures for commercial products, only if such amendments are for EPCA covered



products. In light of the exclusions set forth in Section 3 of ARI Standard 390 (ARI 390), however, the amendments contained in Addendum d appeared not to apply to products covered by EPCA. The draft revision to ARI 390 provided in your November 4 letter eliminates the exclusions just referred to and instead contains a subsection on "Applicability" which provides that other ARI rating standards for small and large commercial equipment will not apply to SPVUs. These proposed changes to ARI 390 indicate that any standards and test procedures that ASHRAE prescribes for SPVU products would apply to equipment covered by EPCA, and appears to resolve the first issue raised in our letter of July 25.

As to the second issue, you have redefined SPVACs and SPVHPs as a type of air-cooled small or large commercial package air conditioning and heating equipment, and have created categories for these products that correspond to product categories in EPCA, with standards for each category. Included in these revisions is the removal of certain products from Addendum d and ARI 390, so as to eliminate some overlapping product categories. As now written for SPVUs:

- SPVAC do not include reverse cycle refrigeration as a heating means;
- SPVHPs use reverse cycle refrigeration as its primary heat source;
- The cooling capacity ranges for SPVAC products includes: <65,000 Btu/h (65 kBtu/h) three-phase single package equipment, <65 kBtu/h single-phase single package equipment, ≥65 kBtu/h to 135 kBtu/h single-phase or three-phase single package equipment, and ≥135 kBtu/h to 240 kBtu/h single-phase or three-phase single package equipment;
- All covered SPVU products use air cooled condensers; and
- Single-phase SPVU product condensers are located with the evaporator.

Your deletion of the term "unencased" from the SPVU definition clearly differentiates the SPVU class from packaged terminal air conditioners and packaged terminal heat pumps and removes overlap with the EPCA definitions for these products.

Revised Tables 1 and 2 of ARI 390 and Addendum d now clearly show that the amended standards and test procedures apply only to air-cooled air-conditioners (ACs) and heat pumps (HPs). Previously the range of products covered by Addendum d was unclear. As a result of the suggested modifications, the proposed ASHRAE 90.1-2001 Table 6.2.1D now differentiates subcategory or rating conditions consistent with the product categories in EPCA.

If the proposed ASHRAE addendum is accepted as shown, the amended ASHRAE Standard 90.1-2001 and ARI 390-2003 would have product subcategories for SPVUs that are uniquely defined, consistent with preexisting EPCA provisions and clearly delineated products to which Standard 90.1 amendments apply.

The third issue concerned EPCA requirements that new standard levels not be lower than current efficiency requirements. In its review of Addendum d, the Department identified several instances where it appeared there was a lowering of standards:

- AC/HP 65-135 kBtu/h cooling where your proposed 8.6 energy efficiency ratio (EER) was below the EPCA 8.9 EER;
- AC/HP 65-135 kBtu/h heating where your proposed 2.7 COP was below the EPCA 3.0 COP;
- HP 135-240 kBtu/h heating where your proposed 2.7 COP was below the EPCA 2.9 COP;
- Packaged terminal air conditioners/package terminal heat pumps (PTAC/PTHP) cooling where your proposed 8.6 EER for products below 7000 Btu/h was below the EPCA 8.88 EER; and
- PTHP heating where your 2.7 COP for products below 7000 Btu/h was below the levels established by EPCA for that capacity range of PTHP.

The statute prescribes the minimum efficiency standards just referred to in 42 USC 6313(a).

Your efforts to resolve efficiency standard problems in the revised Standard 90.1 Addendum d include:

- For SPVUs between 65-135 kBtu/h – You proposed a minimum EER of 8.9 for SPVACs and a minimum EER of 8.9 and COP at 47°F of 3.0 for SPVHPs. These levels are equivalent to the existing federal minimums.
- For SPVUs between 135 - 240 kBtu/h – You proposed a minimum EER of 8.6 for SPVACs and a minimum EER of 8.6 and COP at 47°F of 2.9 for SPVHPs. The proposed EER is greater than the existing federal minimum 8.5 EER and the proposed COP equivalent to the existing federal minimum.
- By removing PTACs and PTHPs from Addendum d and ARI 390, you have eliminated the problem identified by DOE. There is no reduction in efficiency as they are not covered in the proposed amended standard.

As to SPVU equipment less than 65 kBtu/h, in addition to your letter with attached revised ARI Standard 390, we have reviewed the three graphs (exhibits 2-4) showing the relationship between seasonal energy efficiency rating (SEER) and EER for SPVACs and SPVHPs and the relationship between heating seasonal performance factor (HSPF) and coefficient of performance (COP) for SPVHPs. ARI has proposed to change the rating metrics associated with these products from SEER to EER for cooling and from HSPF to heating COP for heating, and has proposed a standard level of 8.9 SEER and 2.7 COP. We agree that the change to using the EER/COP energy descriptors is significant and more properly reflects the intended use of SPVUs as commercial equipment. However, EPCA precludes the Department from adopting the proposed EER and COP levels in Addendum d unless they are at or above EPCA's current required efficiency (expressed in terms of SEER and HSPF levels) for three-phase products below 65 kBtu/h cooling capacity.

The SEER and HSPF metrics were developed to measure efficiency in residential applications based on operation of equipment throughout the course of a year, whereas

the EER and COP metrics rate a product's efficiency without regard to its application or seasonal variations. Because they take into account the variation of performance with ambient conditions and with cycling losses, the SEER and HSPF metrics consider more factors and are more complicated rating procedures than the EER and COP metrics. As with many rating metrics that are used for essentially the same purpose, there is not a one-to-one correspondence between ratings produced under SEER and EER or HSPF and COP. Differences in product design may result, for example, in a group of products that are all at one rating level under the first metric but have a distribution over a range of levels under the second metric. Thus, assuring that standards prescribed under a new metric would provide energy efficiency levels equivalent to the levels under the previous metric is complicated and not an exact science.

The differences between SEER and EER are less significant, and the two metrics are more comparable, than is true for the HSPF and COP metrics. As indicated above, both SEER and HSPF include consideration of cycling losses, which are not part of EER or COP. As a general rule, however, the impact of such losses is less significant in commercial than residential equipment. In addition, the presence of a default value for the cycling loss degradation coefficient in the SEER metric, limits the amount the SEER test procedure actually constrains these losses. As to the other factors considered in the SEER metric but not in EER, the absence of any of these factors from the EER metric would intrinsically allow a product rated by EER to be less efficient than if rated by SEER.

Comparing SEER and EER ratings for current models of SPVAC equipment less than 65 kBtu/h, the data that you provided identified only one SPVAC product with a SEER of 9.7, the minimum cooling efficiency level currently prescribed for these products by EPCA. (One other product identified in your data as having a SEER of 9.7 appears to have been an SPVHP misclassified as an SPVAC). The EER for this SPVAC was 8.5. Your proposal of an EER of 8.9 is clearly above this level. However, there were 16 other products with a SEER of 10 and with EERs ranging from 8.9 to 9.7, averaging 9.21. The average difference between SEER and EER ratings is, therefore, approximately 0.8 points. If the same difference in rating was added to your proposed 8.9 EER, the corresponding SEER would be 9.7. This suggests that products designed to the proposed 8.9 EER level would provide roughly the same level of efficiency as products designed to the existing SEER 9.7 rating.

For current models of SPVHP equipment less than 65 kBtu/h, the data that you provided identified only one SPVHP product with a SEER of 9.7, and it had an EER of 8.5 (see previous paragraph). There were, however, 14 SPVHP products with a SEER of 10.0. The average EER for these products was 9.13. The average difference between SEER and EER ratings for these products, therefore, is approximately 0.87 points, suggesting that an EER of 8.9, as ARI is proposing, corresponds roughly to a SEER rating of nearly 9.8 for these products. This exceeds the current SEER rating of 9.7. This again suggests that the proposed 8.9 EER will maintain roughly the same level of cooling efficiency as the current standard and may even be a slight increase.

The foregoing information indicates that the EER level proposed in Addendum d for three-phase SPVU equipment less than 65 kBtu/h is at or above the current EPCA cooling efficiency level for these products.

With respect to the proposed minimum COP, we note initially the differences between the current HSPF metric and the COP metric. The HSPF procedure requires measurement of full load performance (COP) at two sets of outside air conditions, 47°F and 17°F. In addition, it includes provisions for a cycling loss degradation factor (discussed above), provides assumptions for the fractions of heating hours at different conditions, and takes into account the backup electric resistance heat typically installed with these products. By contrast, COP is a full load measurement of performance at one specified set of conditions.

For current models of SPVHP equipment less than 65 kBtu/h, the data you provided indicates that 26 models have an HSPF of 6.6, the minimum heating efficiency level currently permitted under EPCA. The COPs for these models range from 2.7 to 3.0, averaging 2.86. You have proposed to set a minimum COP at 2.7. This is the COP rating for approximately 10 percent of the current SPVHP models less than 65 kBtu/h, and is the lowest COP rating for any SPVHP currently on the market. Moreover, this proposed heating efficiency level does not address energy that SPVHPs use, first, to provide electric resistance backup heat needed to meet the heating load at low temperatures, and, second, to defrost the outdoor coil. Because the existing HSPF metric takes account of such energy – particularly for electric resistance heat – it appears that your proposed standard would allow any SPVHP subject to the standard to have a lower overall efficiency (net space heating output over electrical input) than is currently required.

Notwithstanding that the proposed 2.7 COP level may represent a lower efficiency than the current 6.6 HSPF level, conceivably the combined effect of the proposed EER of 8.9 and COP of 2.7 would be such that the proposed standard would not represent a decrease of the minimum efficiency currently required for SPVHPs, although the Department is aware of no information that would establish such a conclusion. But even if this type of information exists, it may not be possible to accept a standard for SPVHPs that fails to address electric resistance heat, because such a standard might inherently allow products to be less efficient than required by current standards.

In sum, we are still concerned about whether Addendum d's COP level for three-phase SPVUs below 65,000 Btu/h cooling capacity is at or above the current EPCA level for these products. We would strongly suggest that, if ARI still wishes to pursue a new heating efficiency level for these products, you either provide us with information demonstrating that the proposed COP level meets this requirement, or consider proposing a new heating efficiency requirement.

Finally, we intend to proceed with a screening analysis on those SPVU products for which ARI's proposed standard is at or above the EPCA level, to determine whether DOE should explore the development of more stringent standards. In addition, we are

reviewing whether the new test procedures in ARI 390 meet the statutory requirements that they be reasonably designed to assess the products and produce accurate results, and not be unduly burdensome to conduct. We also need to determine whether the ARI 390 test procedure would produce any changes in measured efficiency levels and, if so, what those changes would be and whether they would affect your proposed standards.

The above represents staff opinion and does not necessarily represent the views of the Secretary or official Department of Energy policy.

We hope this additional feedback is helpful in moving this issue forward. If you have any questions or wish to discuss any of the above points further, please contact Ms. Maureen Murphy of my staff at 202-586-0598.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael J. McCabe", written over a horizontal line.

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